combination of surface runoff and seepage can lead to the development of large gullies. Slope failures may be classified as: falls and topples; rotational (i.e., circular) and translational slides; and, spreads and flows. The type of failure is a function of the geologic conditions at the site. There are a variety of methods for assessing slope stability.

(4) Figures III-5-21 to III-5-23 show some examples of eroding bluffs along the Great Lakes. Recent rotational failures are evident in Figure III-5-21 along the north central shore of Lake Erie. The development of a gulley is shown in Figure III-5-22 from another location on the north central shore of Lake Erie. Figure III-5-23 shows an eroding shale bluff along the western Lake Ontario shoreline.

Figure III-5-21. A rotational bluff failure along the north central shore of Lake Erie

(5) In addition to slope stability, surface erosion of the cliff or bluff face can have a secondary influence on the overall erosion of the feature. Surface erosion results from runoff, seepage, rain, and spray from wave action. This would be one of the key processes leading to the erosion of the shale bluff shown in Figure III-5-23.

(6) Edil and Bosscher (1988) present a Great Lakes perspective overview of forces and resistance influencing cohesive shore slope erosion which result in mass movement (including sliding, flow, and creep) and particle movement (including wave, wind, ice, rill and sheet erosion and sapping through seepage flow).

(7) Kuhn and Osborne (1987) investigated the recession of cohesive cliffs on the California coast. The short-term cliff recession is partly related to subaerial processes such as drainage of precipitation and the effects of urbanization at the cliff top. At these locations the cliff base is well protected by a substantial beach deposit which restricts the downcutting of the subaqueous profile. Notably, almost all of the sand at these sites is supplied by nearby rivers and not by cliff recession. This is in contrast to the Great Lakes and barrier islands on the U.S. east coast, where very little sand is supplied by rivers in most areas.